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Renal morphological description of brown brocket deer, *Mazama gouazoubira*, Fisher 1814 (Artiodactyla; cervidae)

Descrição morfológica renal do veado-catingueiro, *Mazama gouazoubira*, Fisher 1814 (Artiodactyla; Cervidae)

Descripción morfológica renal del ciervo rojo, *Mazama gouazoubira*, Fisher 1814 (Artiodactyla; Cervidae)

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Abstract

The brown brocket deer (*Mazama gouazoubira*) is a deer that lives in South America, particularly in Brazil and nearby countries such as Uruguay and Argentina. This study aimed to describe the topography, morphology, wraps and renal arterial segments of brocket deer. Used two specimens of *M. gouazoubira*; through dissection, the skin was completely removed and later scored the arteries of animals with stained latex red later the animals were fixed in a formaldehyde solution 10%. Sequentially through a ventral access block was removed from the animal gut and kidneys disjoint this block. The right kidney located at the level of the vertebrae L1-L3 and the left kidney at the level of vertebrae L2-L4 were presented rounded with smooth convex faces without lobation, wrapped sequentially by a thin fibrous capsule, the renal fat and fascia capsule. Medial to each kidney, the adrenal glands were. Renal artery forked in the hilar region in the cranial and caudal artery sectoral and one of these sectoral arteries (cranial and caudal) originated five main segments directed to the ventral region and the dorsal region each kidney, these segments are again bifurcated arterial segments totaling 14. Microscopically the kidneys presented similar organization to that presented by the ruminants with cortical and medullary region with fused lobes. The kidneys brocket deer resemble the kidneys of other ruminants in general, and to carnivores. Thus, its morphology, topography and the renal arterial segments and anatomical and surgical territories of the species studied have been shown to be unique.

Keywords: Renal artery; Kidney; Brocket deer; *Mazama gouazoubira*.

Resumo

O veado-catingueiro (*Mazama gouazoubira*) é um cervídeo que vive na América do Sul, em especial no Brasil e países próximos como o Uruguai e a Argentina. Este estudo teve como objetivo descrever a topografia, morfologia, os envoltórios e os segmentos arteriais renais do *M. gouazoubira*. Utilizaram-se dois espécimes e através da dissecação, a pele foi completamente removida e posteriormente se marcou as artérias de um animal com látex vermelho, posteriormente os animais foram fixados em solução de formaldeído a 10%.

Sequencialmente através de um acesso ventral o bloco de vísceras foi removido do animal e os rins disjuntos deste bloco. O rim direito localizado ao nível das vértebras L1-L3 e o rim esquerdo ao nível das vértebras L2-L4, apresentaram se arredondados, com faces convexas lisas sem lobação, envolvidas por uma delgada cápsula fibrosa, cápsula adiposa e pela fáscia renal. Medialmente a cada rim, estavam as glândulas adrenais. A artéria renal bifurcou-se na região hilar em a artéria setorial cranial e caudal, sendo que uma destas artérias setoriais (cranial e caudal) originou cinco segmentos principais direcionados para a região ventral e para a região dorsal de cada rim, estes segmentos se bifurcaram novamente totalizando 14 segmentos arteriais. Microscopicamente os rins apresentaram organização similar a apresentada pelos ruminantes com região cortical e medular com lobos fundidos. Os rins dos espécimes se assemelham aos rins de outros ruminantes em geral e aos dos carnívoros. Assim sua morfologia, topografia e os segmentos arteriais renais e consequentemente os territórios cirúrgicos estudada têm se demonstrado únicos.

Palavras-chave: Artéria renal; Rim; Veado-catingueiro; *Mazama gouazoubira*.

Resumen

El venado bovino (*Mazama gouazoubira*) es un venado que vive en América del Sur, especialmente en Brasil y países cercanos como Uruguay y Argentina. Este estudio tuvo como objetivo describir la topografía, morfología, envolturas y segmentos arteriales renales de *M. gouazoubira*. Se utilizaron dos especímenes y mediante disección se removió completamente la piel y posteriormente se marcaron las arterias de un animal con látex rojo, posteriormente se fijaron los animales en solución de formaldehído al 10%. Secuencialmente a través de un acceso ventral se extrajo el bloque de vísceras del animal y los riñones se separaron de este bloque. El riñón derecho ubicado a nivel de las vértebras L1-L3 y el riñón izquierdo a nivel de las vértebras L2-L4, eran redondeados, con caras lisas convexas sin lobulación, rodeadas por una fina cápsula fibrosa, cápsula adiposa y fascia renal. Medialmente a cada riñón estaban las glándulas suprarrenales. La arteria renal se bifurcó en la región hiliar hacia la arteria sectorial craneal y caudal, y una de estas arterias sectoriales (craneal y caudal) originó cinco segmentos principales dirigidos a la región ventral y la región dorsal de cada riñón, estos segmentos bifurcados de nuevo totalizando 14 segmentos arteriales. Microscópicamente los riñones mostraron una organización similar a la que presentan los rumiantes con regiones corticales y medulares con lóbulos fusionados. Los riñones de los especímenes son similares a los riñones de otros rumiantes en general y a los de los carnívoros. Así, su morfología, topografía y

segmentos arteriales renales y consecuentemente los territorios quirúrgicos estudiados han resultado ser únicos.

Palabras clave: Arteria renal; Riñón; Ciervo; *Mazama gouazoubira*.

1. Introduction

The brown brocket deer *Mazama gouazoubira*, is a species it lives in South America, especially in Brazil and nearby countries such as Uruguay and Argentina. It is a frugivorous ungulate ruminant with diurnal habits and unbranched antlers (Tiepolo & Tomas 2006; Angeli, Oliveira & Duarte 2014; Ferreguetti, Tomás & Bergallo 2015; Bonifácio, Schiavetti & Freire 2016). Anatomical descriptions of wild animals have been acknowledged due to the considerable amount of descriptions pertaining domestic animals, therefore researches seek to provide data to support future studies, such as physiology and clinical veterinary. Concerning *M. gouazoubira*, there are anatomical descriptions about structures of the nervous system (Martins et al., 2013; Vieira et al., 2013; Lima et al., 2010), circulatory system (Melo et al., 2011; Pérez & Erdoğan 2014; Amadori 2012), digestive system (Pérez & Vazquez 2012), male reproductive system (Costa et al., 2011) and respiratory system (Martins et al., 2014). Thus, the literature requires more studies to enrich the morphological descriptions and to minimize the gaps, for example studies focused in the renal anatomy of the brown brocket deer and other wild animals.

The kidney is responsible for plasma filtration, using around 20% of blood from the abdominal aorta, through the renal arteries, for its metabolic and excretory functions. In ruminants, the kidneys are usually a parallel pair located in the lumbar region. This organ presents renal arteries (right and left) as well as renal veins (right and left). These vessels usually originate from the abdominal aorta and the inferior vena cava, respectively (Abidu-Figueiredo et al., 2009). The morphological study of this organ should receive great significance, due to its indispensable metabolic function and several anatomical variations described in animals, especially those related to vascularization (De Oliveira 2011).

Anatomical studies on the renal system contribute directly to the aid of diagnostic imaging techniques, such as ultrasonography (Rossi, 2012) and to the success of several surgical practices and clinical interventions, including renal trauma treatment, vascular reconstruction, laparoscopy, angioplasty and transplantation (Abidu-Figueiredo et al., 2009; Pinto Filho 2013). In experimental surgery, partial resection of organs depends directly on the anatomical knowledge of segments (De Oliveira 2011).

In view of the scarcity of studies about wild ruminants renal system, and the necessity to contribute to the morphological description of *M. gouazoubira*, this study aimed to perform a macroscopic and microscopic morphological description of the kidney of this species. In addition, these data were compared to information from other species present in the literature. Studies of this nature substantiate the creation of a database about wild animals morphology, thus, providing morphological data essential for surgical interventions aimed at the preservation of the species.

2. Methodology

Two specimens of *Mazama gouazoubira*, a female and a male, were collected on BR-364 a highway, where they had been killed by accident and then sent to the Human and Comparative Anatomy Laboratory of the Federal University of Jataí. This is a descriptive and qualitative study (Pereira et al., 2018) and was approved by the Committee on Ethics in the Use of Animals of the UFPR (CEUA/Palotina), with protocol number 37/2018, accord the parameters and criteria required by the National Council for Control of Animal Experimentation (CONCEA), the work obeyed the by current legislation (Law 11.794/2008 regulating Animal Research in Brazil).

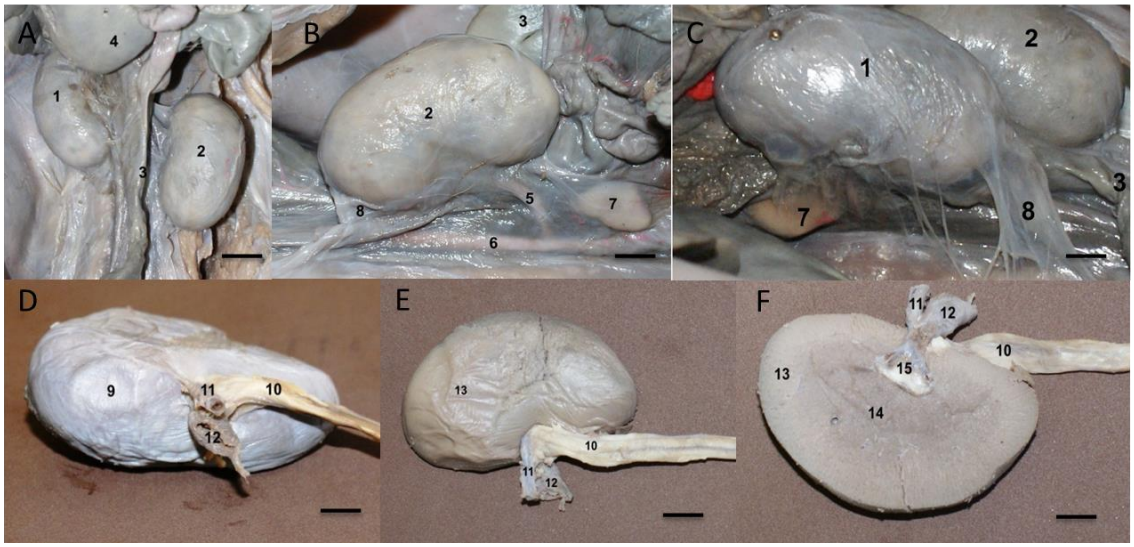
Through dissection the skins of the specimens were removed and performed access to the abdominal cavity. The organs were removed from the abdominal cavity of the pair. In a specimen a latex solution with red dye was injected into the renal artery, and waited 24hours for the latex to cover all branches arteries, coloring them. The kidneys was fixed in solution aqueous solution of 10% formaldehyde and stored in a vat covered in order to preserve the structures. From the renal artery, its segments were dissected and observed with the aid of a Leica EZ4 Stereoscopic Binocular Microscope -HD, where the results were documented by two cameras, a Sony α200 - 10.2 mpx and another specific coupled to the stereoscopic microscope, therefore, the findings with the data from the existing literature on domestic carnivores and described in accordance with the International Committee Veterinary Gross Anatomical Nomenclature (2017).

The fragments submitted to histology were processed by standard paraffin-embedded light microscopy techniques. Histological sections were made with 5 μm thickness in a semi-automatic microtome (Leica RM2235). Then, the sections were placed on slides and stained with hematoxylin and eosin (HE). After stained and ready, the slides were observed under an optical microscope with coupled camera (Leica ICC50 HD).

3. Results and Discussion

The kidneys were located in the retroperitoneum, parallel to the abdominal cavity, in the anatomical position (left and right antimeres).The left kidney was located caudally to the liver, at L1-L3 vertebrae level and the right at L2- L4 level. They presented rounded extremities (cranial and caudal) and convex smooth faces (dorsal and ventral), without lobation (Fig. 1A). The adrenal glands were present medially to each kidney (Fig. 1B and 1C), separated from them, although, surrounded by the peritoneum, the left one medial to the cranial extremity of the left kidney and the right gland closer to the renal hilum of the right kidney.

Figure 1. (A) Ventral view of the kidneys.

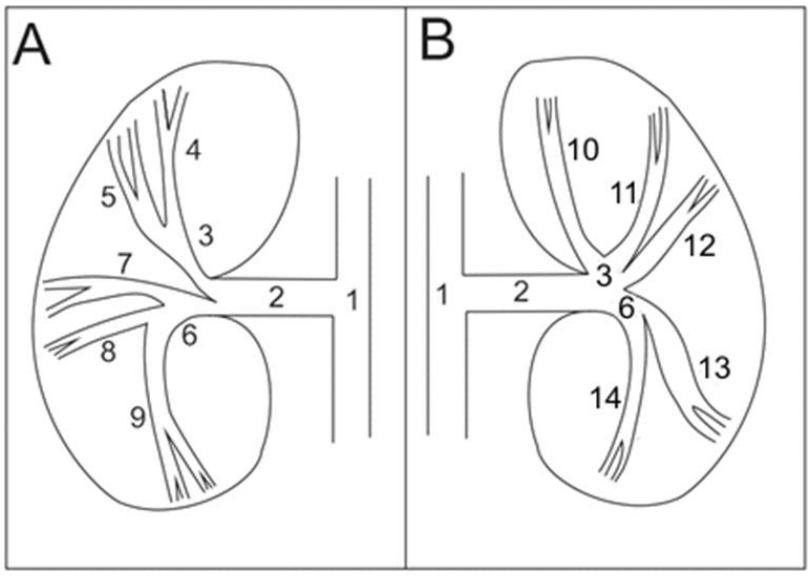


(A) Ventral view of the kidneys. (B) Dorsal view of left kidney. (C) Dorsal view of right kidney. (D) Renal hilum. (E) External surface of the kidney. (F) Sagittal section of the right kidney. Right kidney (1), Left kidney (2), Sigmoid colon of the intestine (3), Liver (4), Renal artery (5), Aorta artery (6), Adrenal gland (7), renal fascia fibrous capsule (8), fibrous capsule (9), right ureter (10), Right renal artery (11), Right renal vein (12), Renal cortex (13), Renal medulla (14), Renal pelvis (15). Scale = 1cm. Source: Authors.

A thin fibrous capsule involve these organs, which was adhered to the renal parenchyma, sequentially an adipose capsule and the renal fascia were present, connecting the kidneys to the abdominal wall (Fig. 1A and C). In the hilum region, the renal vein, the renal artery and the ureter were identified. The artery was located laterally to the ureter and cranial to the renal vein. In a sagittal section of the organ, the renal parenchyma was identified, presenting the cortical and medullary zones. At the end of the medulla, the renal pelvis and, sequentially, the vessels and the renal ureter were observed (Fig. 1D and F).

Through an hilum access, the renal artery was dissected from its origin, trajectory and end. Initially, it presented two segments: the cranial sector artery and the caudal sector artery. Each of these originated five segments, directed to the ventral and dorsal renal regions (Fig. 2A, 2B and 4) and Table 1.

Figure 2. Scheme of the right kidney and arterial segments of *Mazama gouazoubira*.



Scheme of the right kidney and arterial segments of *Mazama gouazoubira*. (A) Ventral face: Descending aorta (1), Right renal artery (2), Cranial sector artery (3), Cranio ventral segment (4), Cranio medium ventral segment (5), Caudal sector artery (6), Caudo ventral segment (7), Caudo medium ventral segment (8), Caudo cranio ventral segment (9). (B) Dorsal face: Descending aorta (1), Right renal artery (2), Cranio dorsal segment (10), Cranio medium dorsal segment (11), Caudo cranio dorsal segment (12) Caudo medium dorsal segment (13), Caudo dorsal segment (14). Source: Authors.

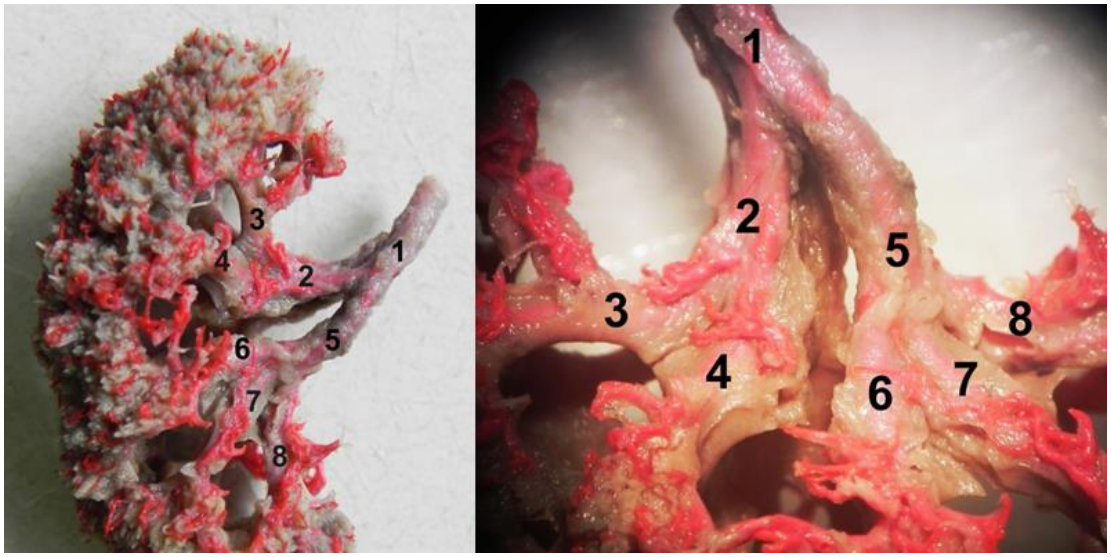
Table 1. Presentation of the numbers of anatomic-surgical segments.

	Artery	Segment	No. of segments
Renal Artery	Cranial sector artery	Cranio ventral segment	2
		Cranio medium ventral segment	1
		Cranio dorsal segment	1
		Cranio medium dorsal segment	1
		Cranio caudo dorsal segment	2
		Total:	7
	Caudal sector artery	Caudo ventral segment	1
		Caudo medium ventral segment	1
		Caudo cranio ventral segment	2
		Caudo medium dorsal segment	1
		Caudo dorsal segment	2
		Total:	7
		Total of segments:	14

Presentation of the numbers of anatomic-surgical segments from the cranial sector artery and caudal sector artery. Source: Authors.

In the ventral region, the cranial sector artery presented the cranio ventral and cranio medium ventral segments while the caudal sector artery presented the caudo ventral, caudo medium ventral and caudo cranio ventral segments (Fig. 2A and 3).

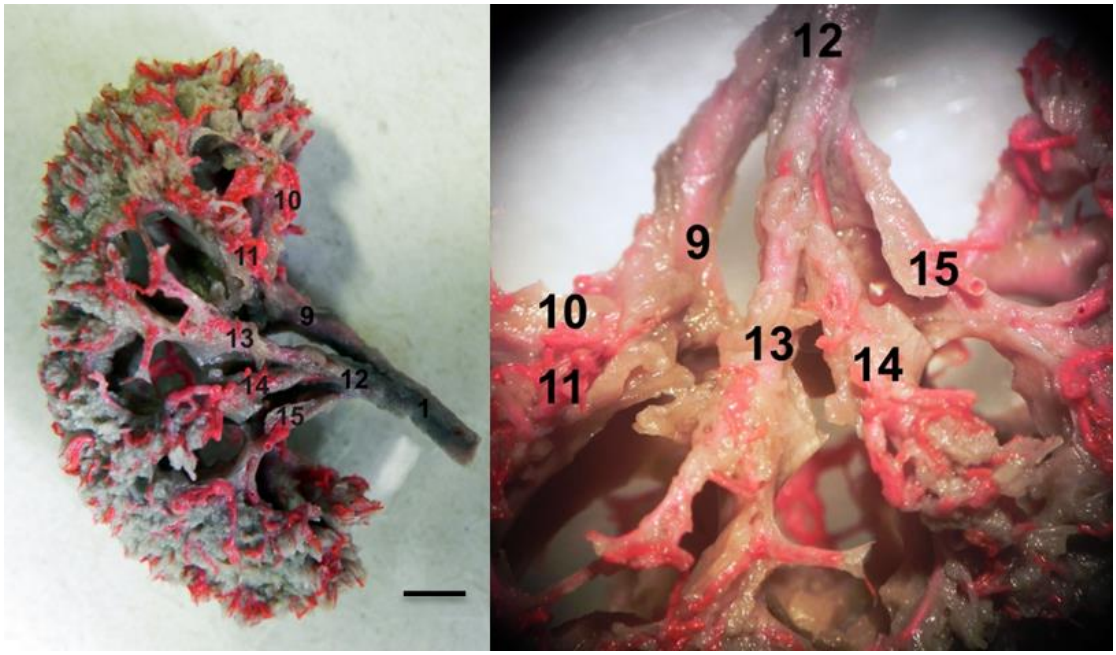
Figure 3. Ventral view of the arterial segments of the right kidney:



Ventral view of the arterial segments of the right kidney: Right renal artery (1), Cranial sector artery (2), Cranio ventral segment (3), Cranio medium ventral segment (4), Caudal sector artery (5), Caudo ventral segment (6), Caudo medium ventral segment (7), Caudo cranio ventral segment (8). Scale = 1cm. Source: Authors.

In the dorsal region, the cranial sector artery presented the cranio dorsal, cranio medium dorsal and cranio caudo dorsal segments while the caudal sector artery presented the caudo medium dorsal and caudo dorsal segments (Fig. 2B and 4).

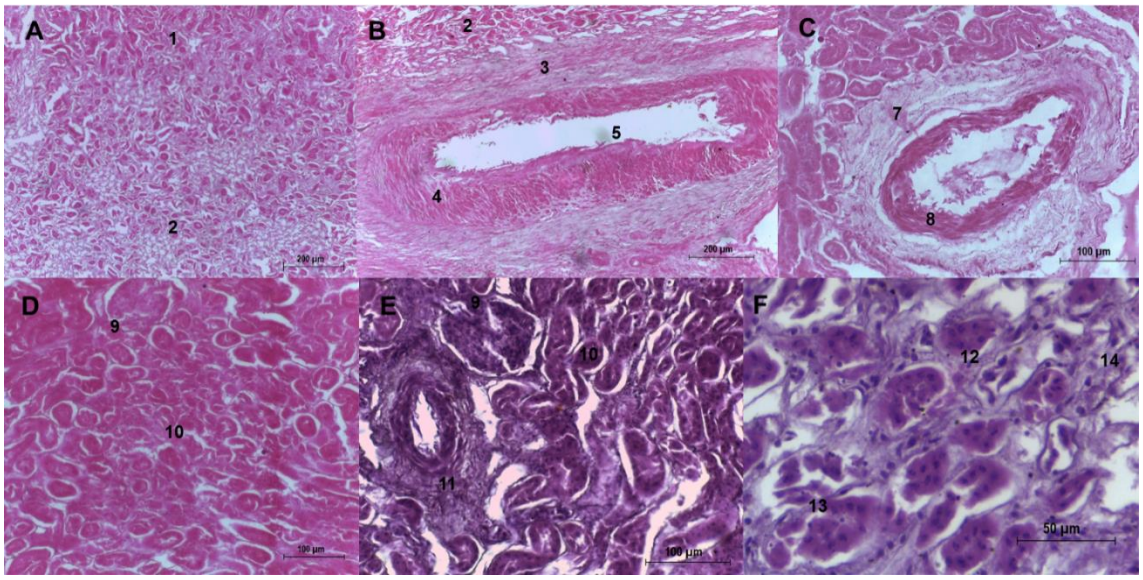
Figure 4. Dorsal view of the arterial segments of the right kidney:



Dorsal view of the arterial segments of the right kidney: Right renal artery (1), Cranial sector artery (9), Cranio dorsal segment (10), Cranio medium dorsal segment (11), Caudal sector artery (12), Caudo cranio dorsal segment (13), Caudo medium dorsal segment (14), Caudo dorsal segment (15). Scale = 1cm. Source: Authors.

Microscopic observation also evidenced the presence of the cortical and medullary regions of the kidney, with fused renal lobes (Fig. 5A). In the medullary region, it was possible to observe the renal calyces and the proximal part of the ureter (Fig.5B), consisting of muscular coat, elastic fibers and transitional epithelium. In the cortical region, it was possible to observe the presence of renal arterioles (Fig.5C), renal corpuscles, constituted by the renal glomeruli and coated by the glomerular capsule (Fig.5D and 5E); the distal and proximal convoluted tubules and the nephron loop were observer near the renal corpuscle (Fig. 5F).

Figure 5. Photomicrography of the kidney and ureter of *Mazama gouazoubira*,



Photomicrography of the kidney and ureter of *Mazama gouazoubira*, evidencing: A – Renal parenchyma highlighting the Cortex (1) and Medulla (2), scale: 200µm. B – Ureter with muscular coat (3 and 4) and transitional epithelium (5), scale: 200µm. C – Renal artery, highlighting the tunica adventitia (7) and mean (8), scale: 100µm. D and E – Kidney cortex with the presence of renal corpuscle - constituted by the glomerulus and Bowman's capsule (9), convoluted tubules (10) and renal arteriole (11), scale: 100µm. F – Proximal convoluted tubule (12), distal convoluted tubule (13) and nephron loop (14), scale: 50 µm. Hematoxylin and eosin stain. Source: Authors.

Some anatomical description studies do not emphasize the importance of morphological and topographic knowledge of the organs, others are restricted to specific structures. In this investigation we compare all descriptive data (morphological and topographic), approaching anatomical and surgical territories, in general. The kidneys of the brown brocket deer presented rounded extremities (cranial and caudal) and convex faces (dorsal and ventral) without lobes, in agreement with the renal morphology described for the red brocket (Meireles, Costa & Dias 2015), Mocó (De Oliveira et al., 2011) and Maned sloth (Bianchi et al., 2012). Abidu-Figueiredo et al., (2009) described in detail the level of origin of each renal artery of the caprine, the first of which originated ventrally to the abdominal aorta, between the third (L3) and fourth lumbar vertebra (L4), the second, ventrally to the abdominal aorta between the L5-L6 vertebrae. The right kidney was located caudally to the liver, at the L1-L3 vertebrae level and the left kidney at the L2-L4 vertebrae level.

The renal arteries (right and left) of the brown brocket deer were bifurcated in two main sector arteries, cranial and caudal; this renal artery pattern was described to the crab-eating raccoon (Barcelos et al., 2012) and ovines (Carvalho 2007). The organ did not present accessory renal arteries or double renal arteries, supporting the anatomical findings from

caprines (Abidu-Figueiredo et al., 2009), dogs (Alonso & Abidu-Figueiredo 2008) and cats (Pestana et al., 2011).

The Mocó (De Oliveira et al., 2011) and crab-eating raccoon kidneys (Barcelos et al., 2012), also presented a single renal artery, however the bifurcation of this vessel occurs before it enters the hilum (pre-hilar region), contradictory to the findings of this work, where the bifurcation in the cranial and caudal segment occurs in the renal hilum. In caprines, the bifurcation is described in the pre-hilar region (Abidu-Figueiredo et al., 2014), as well as in the agouti (Carvalho et al., 2008). Carvalho et al., (2007) study shows that the bifurcation of the renal artery in ovines can occur both in the pre-hilar and hilar regions, agreeing partially to our results Table 2.

Table 2. Segmentation of the renal artery.

Specimen	Renal artery division	Region of division	Predominant number of segments	References
Wild boar	Bifurcation or trifurcation	Hilar region	16	Carvalho et al.
Crab-eating raccoon	Bifurcation	Pre-hilar region	15	Barcelos et al.
Ovine	Bifurcation and trifurcation	Region pre-hilar or hilar region	14	Carvalho et al.
Swine	Bifurcation	Hilar region	10	Romagnolli et al.
Mocó	Bifurcation	Pre-hilar region or hilar region	14	Oliveira et al.
White-lipped peccary	Trifurcation	Pre-hilar region or hilar region	10	Romagnolli et al.
Agouti	Bifurcation	Pre-hilar region	9	Carvalho et al.
Brown brocket deer	Bifurcation	Hilar region	14	This investigation

Segmentation of the renal artery in some species. Source: Authors.

Regarding the bifurcation of the renal artery, it is important to highlight that in this study, the bifurcation occurs in the horizontal plane, dividing it into cranial and caudal sector arteries, while Carvalho et al.(2007), demonstrated that in ovines, the bifurcation occurs in the coronal plane, dividing the artery into ventral and dorsal sector arteries. The branches of the

renal artery of the brown brocket deer bear a resemblance to the red brocket ones. The number of arterial branches in this investigation is 2, in both kidneys, in the red brocket it varies from 1 to 9, and 25% of cases there presents 2 right arterial branches and 16.6% presents 2 left arterial branches (Teixeira Filho, Fernandes Filho & Miglino 1996).

In the white-lipped peccary, the arterial bifurcation pattern was similar to the one described in this study in only 5.55% of the cases, with the right renal artery dividing into: cranial and caudal sectors; however, there was no similarity concerning the left renal artery, which trifurcated in cranial, dorsal and ventral sector arteries (Romagnolli, Valente & Miglino 2003). The wild boar presented the left renal artery segmented in 3 branches with more frequency (38.46%) and the right renal artery ranged from 2 to 6 branches, the most frequent being into 4 branches (30.77%)(30). The crab-eating raccoon also presented cranial and caudal sector artery in the right kidney and the left kidney presented dorsal and ventral sector arteries (Barcelos et al., 2012).

The renal arterial segments found in the ovine (Carvalho et al., 2007) and the brown brocket deer are similar, the only difference being the segmentation region. The number of segments in both ruminants is 14, however, there are trifurcations in two segments of the ovine kidneys, the ventro medium cranial e ventro medium caudal segments; in the brown brocket deer kidney we observed only bifurcations located in the cranio ventral, caudo cranio dorsal, caudo medium ventral and caudo dorsal segments. Although, in the crab-eating raccoon hand-peeled, the white-lipped peccary and the wild boar, there was variation in the number of segments as well as in the segmentation of the sector arteries (Barcelos et al., 2012; Carvalho et al., 2006; Romagnolli, Valente & Miglino 2003; Santos et al., 2013).

The renal histological description of *Mazama gouazoubira* is in accord with the description for the red brocket (Meireles, Costa & Dias 2015) and the maned sloth (Biachi et al., 2012). The structures found were similar to those described in the literature for mammals, so the present study demonstrate that the *Mazama gouazoubira* kidney does not display any histological difference compared to other ruminants (Getty 2008).

4. Conclusion

Concluding, *M. Gouazoubira* kidneys were located lumbar retroperitoneum, presenting smooth surface without lobation and the right kidney in a more caudal position than the left one. The adrenal glands were near and medial to the cranial extremity of the kidneys and surrounded by their own capsule. The kidneys were involved by a fibrous

capsule, adhered to the renal parenchyma, also involved by an adipose capsule and by the renal fascia, which connected the kidneys to the abdominal wall. In renal hilum, it was possible to identify the renal vein, the renal artery and the ureter. The renal artery, located cranially to the renal vein, divided in the renal pelvis into cranial sector artery and caudal sector artery, each with five arterial segments directed to the ventral and dorsal regions of the kidneys. Microscopically, the kidneys presented similar organization to that presented by ruminants, with cortical and medullary region sand fused lobes.

The morphological descriptions concerning the renal anatomy of the brown brocket deer should be considered in the veterinary practice focused on the preservation of the species, such as radiological, surgical, invasive and non-invasive surgical procedures.

References

Abidu-Figueiredo, M., Roza, M. S., Passos, N. C., Silva, B. X., & Scherer, P. O. (2009). Artéria renal com dupla origem na porção abdominal da aorta em caprino. *Acta Vet Bras*, 3(1), 38–42.

Alonso, L. S., & Abidu-Figueiredo, M. (2008). Artéria renal dupla originando da aorta em cão: Relato de caso. *Semin Agrar*, 29(1), 185–8.

Amadori, A., Birck, A. J., Filadelpho, A. L., Guimarães, G. C., Peres, J. A., & Souza, R. A. M. de. (2012). Origem e distribução da artéria celíaca em veado catingueiro (*Mazama gouazoubira*). *Rev científica eletrônica Med Veterinária*. (19), 1–10.

Angeli, T., de Oliveira, M. L., & Duarte, J. M. B. (2014). Differentiation of deer species of the genus Mazama by track morphometry. *Stud Neotrop Fauna Environ*, 49(3), 199–203.

Barcelos, N. B., Santos, É. A. dos., Helrigle, C., & Pereira, K. F. (2012). Descrição anatômica dos segmentos arteriais do rim de mão-pelada (*Procyon cancrivorus*). Biotemas, 25(2), 139–47.

Bianchi, P. K. F., Cardoso, F., Salvadori, M. L. B., Lima, A. R. de, Santos, G. M. F., & Junior, J. R. K. (2012). Morfologia renal do *Bradypus torquatus*. Biotemas, 25(4), 201–5.

Bonifácio, K. M., Schiavetti, A., & Freire, E. M. X. (2016). Fauna used by rural communities surrounding the protected area of Chapada do Araripe, Brazil. *J Ethnobiol Ethnomed*, 12(1), 1–13.

Carvalho, M. A. M. de., Miglino, M. A., Machado, G. V., Machado-Júnior, A. A. N., Vale, E. F., & Azevedo, L. M. de. (2006). Segmentação anatomo-cirúrgica arterial do rim de javali (*Sus scrofa*) adulto. *Biotemas*, 19(4), 85–90.

Carvalho, M. A. M., Vale, E. F., Junior, A. A. N. M., & Neto, A. C. A. (2007). Segmentos anátomo-cirúrgicos arteriais do rim de ovinos da raça Santa Inês. *Biotemas*, 20 (1), 37-48,

Carvalho, M. A. M., Azevedo, L. M., Menezes, D. J. A., Oliveira, M. F., Neto, A. C. A., & Cardoso, F. T. S. (2008). Segmentos anátomo-cirúrgicos arteriais do rim de cutia (*Dasyprocta prymnolopha*). *Pesq Vet Bras*, 28(5), 249–52.

Costa, K. L. C., Da Matta, S. L. P., Gomes, M. L. M., de Paula, T. A. R., de Freitas, K. M., & de Carvalho, F. A. R. (2011). Histomorphometric evaluation of the neotropical brown brocket deer *Mazama gouazoubira* testis, with an emphasis on cell population indexes of spermatogenic yield. *Anim Reprod Sci*, 127(3–4), 202–12.

De Oliveira, G. B., Rodrigues, M. N., De Albuquerque, J. F. G., Menezes, D. J. A., & De Oliveira, M. F. (2011). Vascularização do rim de mocós (*Kerodon rupestris wied*, 1820). *Acta Vet Bras*, 5(3), 291–9.

Ferreguetti, Á. C., Tomás, W. M., & Bergallo, H. G. (2015). Density, occupancy, and activity pattern of two sympatric deer (Mazama) in the Atlantic Forest, Brazil. *J Mammal*, 96(6), 1245–54.

Getty, R. (2008). *Anatomia dos animais domésticos*. (5a ed.) Editora Artmed, Porto Alegre, Rio Grande do Sul.

International Committee Veterinary Gross Anatomical Nomenclature. (2017). Nomina Anatomica Veterinaria. Hannover.

Lima, F. C., Santos, A. L. Q., Lima, B. C., Vieira, L. G., & Hirano, L. Q. L. (2010). Anatomia topográfica da medula espinal e relações vértebro-medulares em *Mazama gouazoubira* Fisher, 1814 (Artiodactyla; Cervidae). *Acta Sci - Biol Sci*, 32(2), 189–94.

Martins, T. M. M., Pereira, K. F., Lima, F. C., Santos, A. L. Q., & Malysz, T. (2013). Origin and distribution of the sciatic nerve in catingueiro-deer (*Mazama gouazoubira*). *Pesq Vet Bras*, 33(2), 273-278.

Martins, T. M. M., Pereira, K. F., Lima, F. C., Fontana, C. A. P., Santos, A. L. Q., & Malysz, T. (2014). Distribution of lobar bronchi of the lungs of brown brocket deer *Mazama gouazoubira*. *Pesq Vet Bras*, 34(5), 473-476.

Meireles, W. A., Costa, F. F., & Dias, D. F. (2015). Avaliação morfológica das vísceras de um exemplar de veado mateiro. *Rev Eletrônica Biol*, 8(2), 207–17.

Melo, A. P. F., De Souza, W. M., Rodrigues, R. F., Alves, F. R., Rici, R. E. G., & Guerra, R. R. (2011). Anatomical Description of Arterial Segments of the Spleen of Deer. *Anat Histol Embryol*, 40(4), 243–48.

Pereira, A. S., et al. (2018). *Metodologia da pesquisa científica*. [free *e-book*]. Santa Maria. Ed. UAB/NTE/UFSM. Recuperado de https://repositorio.ufsm.br/bitstream/handle/1/15824/Lic_Computacao_Metodologia-Pesquisa-Cientifica.pdf?sequence=1.

Pérez, W., & Vazquezc, V. N. (2012). Gross anatomy of the gastrointestinal tract in the brown brocket deer (*Mazama gouazoubira*). *J Morphol Sci*, 29(3), 148–50.

Pérez, W., & Erdoğan, S. (2014). Arterial thoracic vascularization in some deer species: Pampas deer (*Ozotoceros bezoarticus*), brown brocket deer (*Mazama gouazoubira*) and axis deer (*Axis axis*). *Anat Histol Embryol*. 43(6), 490–4.

Pestana, F. M., Dos Santos Roza. M., Hernandez, J. M. F., Silva, B. X., & Abidu-Figueiredo, M. (2011). Artéria renal dupla em gato. *Semin Agrar*, 32(1), 327–32.

Pinto Filho, S. T. L., Brun, M. V., Dalmolin, F., Hartmann, H., Pereira, D. T., & Pohl, V. H. (2013). Ressecção de cisto e abscesso renais por laparoscopia em um cão. *Arq Bras Med Vet e Zootec*, 65(6), 1651–6.

Romagnolli, P., Machado, G. V., & Miglino, M. A. (2003). Arterial segments of kidneys in white-lipped peccaries (*Tayassu pecari* Link, 1795). *Braz. J. Vet. Res. Anim. Sci*, 40(3), 205-12.

Rossi, R. S., Bombonato, P. P., Piva, F. M., & Gregory, L. (2012). Avaliação da morfometria renal através do método ultrassonográfico de fêmeas caprinas (*Capra hircus*) normais da raça Saanen. *Pesq Vet Bras,* 32(2), 165–73.

Santos, A. L. Q., Vieira, L. G., Hirano, L. Q. L., Kaminishi, Á. P. S., Mendonça, J. S., & Rodrigues, T. C. S. (2013) Estudo dos elementos vasculares, arteriais e venosos do hilo renal em javali *Sus scrofa scrofa* (Linnaeus, 1758). *Pubvet*, 7(10), 487–92.

Teixeira Filho, A., Fernandes Filho, A., & Miglino, M. A. (1996). Contribuição ao estudo dos elementos vasculares, arteriais e venosos do hilo renal em bovinos da raça Hereford. *Brazilian J Vet Res Anim Sci*, 33(4), 197.

Tiepolo, L. M. & Tomas W. M. (2006). Ordem Artiodactyla,. In: Reis, N. R., Peracchi, A. L., Pedro, W. A., Lima, I. P., editors. *Mamíferos do Brasil.* vol 1. Londrina.: Universidade Estadual de Londrina.

Vieira, L. G., Ribeiro, P. R. Q., Lima, M. O., Souza, R. R. de, Valdes, S. A. C., & Santos, A. L. Q. (2013). Origens e ramificações do plexo braquial do veado catingueiro *Mazama gouazoubira* (Artiodactyla: Cervidae). *Biotemas*, 26(1), 137–46.

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